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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/815,103	03/31/2004	Keith E. Fogel	YOR920030190US1	6557
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David Aker 23 Southern Road Hartsdale, NY 10530			EXAMINER ANDUJAR, LEONARDO	
			ART UNIT 2826	PAPER NUMBER
			MAIL DATE 10/03/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

Application No.

10/815,103

Applicant(s)

FOGEL ET'AL.

Examiner

Leonardo Andújar

Art Unit

2826

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 04 May 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 15,17-27,29,30,34-36 and 47-51 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 30,34-36 and 51 is/are allowed.
- 6) ☒ Claim(s) 15,17-27,29 and 47-49 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's election without traverse of method of forming a three layer BLM (claims 15-27 and 29-36) in the replies filed on 05/01/2006 and 08/14/2006 is acknowledged.

### *Claim Rejections - 35 USC § 103*

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 15, 17, 19-27 and 47-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over anticipated by Jan et al. (US 7,081,404) in view of Harper.
4. Regarding claim 15, Jan (e.g. figs. 1-4 or 5-8) shows method for forming an interconnection structure suitable for flip-chip attachment of microelectronic device chips to packages, comprising: forming a ball limiting composition (27 or 127, 29 or 129, 32 or 132) on a substrate; forming a resist pattern (31 or 131) on the ball limiting composition; etching the ball limiting composition by using the resist as an etch mask; removing the resist from remaining ball limiting composition; and depositing solder on the ball (35 or 135) limiting composition (col. 7/lls. 64-67 & col. 8/lls. 1-11) but does not teach that the solder is a predominantly Sn lead free solder. Therefore, the step of forming a eutectic solder is not disclosed. However, Harper teaches common lead free eutectic alloys such as 96.5 Sn/3.5Ag; 95Sn/5Sb or 42Sn/58Bi exhibit significantly higher strength and lower

elongation (table 6.2 and pg. 6.14). It would have been obvious to one having ordinary skill in the art at the time of the invention to use predominantly Sn lead free solder such as eutectic 96.5 Sn/3.5Ag; 95Sn/5Sb or 42Sn/58Bi to form an eutectic solder because these solders exhibit significantly higher strength and lower elongation as suggested by Harper.

5. Regarding claim 17, Jan teaches ball limiting composition is formed by: depositing an adhesion (27 or 127) layer on said substrate; depositing a reaction barrier layer (29 or 129) on said adhesion layer; and depositing a solder wettable (32 or 132) layer on said barrier layer.

6. Regarding claim 19, Jan teaches adhesion layer is deposited by sputtering, plating or evaporating (col. 4/lls. 64-67).

7. Regarding claim 21, Jan teaches that the reaction barrier is formed by sputtering (col. 1/lls. 45-48). 97

8. Regarding claim 25, Jan teaches the step of depositing a layer comprising Au or Sn on the solder wettable layer (e.g. capping layer, col. 1/lls. 29-41).

9. Regarding claims 23 and 27, Jan teaches that the solder wettable layer is deposited by electroplating (col. 5/lls. 24-37).

10. Regarding claim 47, Harper teaches that the predominantly Sn lead free solder contains greater than 90 % by weight Sn.

11. Regarding claim 48, Harper teaches that the predominantly Sn lead free solder contains one or more alloying components selected from the group consisting of Ag, Bi

and Sb, whereby the lead-free solder substantially avoids alpha particle emission and induced soft logic errors which result therefrom (inherent property of the alloy).

12. Regarding claim 49, Jan teaches that the solder wettable layer comprises Cu (col. 8/lis. 1-11).

13. Regarding claims 20, 22, 24, 26 and 50; Jan in view of Harper fails to specify the thickness of the adhesion layer, reaction layer, solder wettable layer, and Au or Sn layer. However, differences in thickness will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such thickness and/or concentration are critical. "Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the workable ranges by routine experimentation". *In re Aller*, 220 F.2d 454,456,105 USPQ 233, 235 (CCPA 1955).

Since the applicant has not established the criticality (see next paragraph) of the adhesion layer, reaction layer and solder wettable layer thicknesses, it would have been obvious to one of ordinary skill in the art to use these values in the device of Jan.

#### CRITICALITY

14. The specification contains no disclosure of either the critical nature of the claimed mole ratio or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

15. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over anticipated by Jan et al. (US 7,081,404) in view of Harper further in view of Lee et al. US (6,756,671).

16. Regarding claim 18, Jan in view of Harper teaches most aspects of the instant invention including lead free solder bump and reaction barrier (BML) made of Cr-Cu (col. 1/lls. 54-62 7 col. 2/lls. 40-42) but does not disclose that the reaction barrier (i.e. first layer of the BML) can be made of a material selected for the group consisting of Ti, TiN, Ta, TaN, Zr, ZnN, V and Ni. However, Lee teaches that Cr--Cu, Ti--Pd, Ti--W, or Ti--Pt are suitable BML (col. 2/lls.46-62). It would have been obvious to one having ordinary skill in the art at the time the invention was made to make the reaction barrier (i.e. first layer of the BML) of Jan consisting of Ti as suggested by Lee, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended (e.g. gold bump) use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

17. Claim 29 is rejected under 35 U.S.C. 102(e) as being anticipated by Jan et al. (US 7,081,404) in view of Harper further in view of Liang (US 5,532,612).

18. Regarding claim 29, Jan in view of Harper shows most aspects of the instant invention except for the step of annealing at 150-250 degrees for 30 to 60 minutes. However, Liang teaches the step of annealing a bump for 30 minutes (col. 7/lls. 49-54). It would have been obvious to one having ordinary skill in the art at the time the invention was made to anneal the bump for at least 30 minutes as suggested by Liang to increase the strength and the reliability of the bump. Although Jan in view of Harper further in view of Liang does not teach the specific temperature range, differences in temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such temperature ranges are critical.

"Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the workable ranges by routine experimentation". *In re Aller*, 220 F.2d 454,456,105 USPQ 233, 235 (CCPA 1955).

***Allowable Subject Matter***

19. Claims 30, 34-36 and 51 are allowed.

***Response to Arguments***

20. Applicant's arguments filed on 5/04/2007 have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

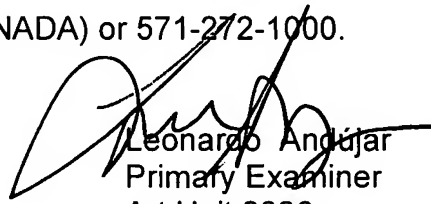
21. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leonardo Andújar whose telephone number is 571-272-1912. The examiner can normally be reached on Mon through Thu from 9:00 AM to 7:30 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on 571-272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Leonardo Andújar  
Primary Examiner  
Art Unit 2826

9/27/2007